16 Flood Risk and Surface Water Drainage

Introduction

16.1 This chapter of the PEIR provides a preliminary assessment of the effects of the OMSSD project during its construction and operational phases in respect of flood risk and surface water drainage. The preliminary assessment has been undertaken by Ramboll UK Ltd.

16.2 This preliminary assessment is based on the baseline conditions and design information available at the time of writing this PEIR. A full assessment will be undertaken as part of the EIA and will be reported in the Environmental Statement (ES) that will be submitted with the DCO submission.

16.3 The assessment undertaken follows best practice with reference to the National Policy Statement for Ports (NPSfP)[505] and the National Planning Policy Framework (NPPF). The NPSfP states that all applications for port development of 1ha or greater in Flood Zone 1 and all proposals for projects located in Flood Zones 2 and 3 should be accompanied by a Flood Risk Assessment (FRA)[506]. A FRA of the OMSSD project is being undertaken, and it is envisaged that this will form a standalone document which would form an Appendix to the OMSSD ES. The FRA will consider the risk of flooding arising from the OMSSD project in line with the relevant sections of the NPSfP and the NPPF and will be proportionate to the risk and appropriate to the scale, nature and location of the OMSSD project. The FRA will specifically consider the potential effects of tidal, fluvial, groundwater, pluvial and artificial sources of flooding to the OMSSD project and will consider the potential for changes to such flood risks as a result of the OMSSD project to off-site receptors, in accordance with national and local planning policy.

16.4 For the purposes of the PEIR, the assessment of flood risk has been considered within this chapter rather than within a stand-alone document, although a separate FRA report is being prepared and would form an Appendix to the Flood Risk and Surface Water Drainage chapter of the OMSSD ES. The flood risk and surface water drainage assessment, ultimately to be contained within the OMSSD ES and the FRA, will follow the requirements of the NPSfP[507].

[505] Department for Transport (2012) National Policy Statement for Ports

[506] DfT (2012) National Policy Statement for Ports – paragraph 5.2.4.

[507] DfT (2012) National Policy Statement for Ports – paragraph 5.2.5.

Definition of the Study Area

16.5 The study area is defined as that area within a 1 km radius of the site of the OMSSD project. However, the Environment Agency (EA) assesses surface water and groundwater quality at a river catchment level. Therefore, when considering the potential for impact on downstream water quality in this chapter, the potential for impacts at a river catchment level have been considered, rather than an area limited to a 1km radius.

Assessment Methodology

16.6 This chapter provides a preliminary consideration of potential flood risk impacts – including tidal, fluvial, pluvial, groundwater and artificial sources – as well as surface water drainage impacts likely to arise as a result of the OMSSD project.

16.7 As there is no published guidance for the assessment of water resources in EIA terms, the assessment has been undertaken by means of professional judgement. This assessment has taken account of applicable legislation, guidance and policy.

16.8 A desktop study has been carried out to identify water resource receptors and features at or adjacent to the site as well as within the study area. An analysis of potential impacts on identified receptors was based on the source-pathway-receptor model whereby a potential pathway for an impact source to reach a receptor was assessed.

16.9 The sensitivity of receptors has been classified as low, medium or high, in accordance with the criteria set out in Table 16.1.

Table 16.1: Receptor Sensitivity Criteria

Sensitivity	Criteria
Low	Feature of low quality and rarity, with potential for substitution or where flood risk is more likely to be acceptable in accordance with the criteria of the NPPF, e.g. • Surface water with a River Basin Management Plan (RBMP) classification of 'Moderate' or 'Poor' • Sewer • Land uses defined under the Planning Practice Guidance Flood Risk Vulnerability Classification as being "Less Vulnerable" (examples include buildings used for shops; financial, professional and other services).
Medium	Feature of medium quality and rarity, with some potential for replacement or where flood risks could be managed with suitable mitigation to ensure occupant safety, e.g. • Surface water with a RBMP classification of 'Good' • Land uses defined under the Planning Practice Guidance Flood Risk Vulnerability Classification as being "More Vulnerable" (examples include buildings used for dwelling houses or non–residential uses for health services, nurseries and educational establishments).
High	Feature of high quality and rarity, with limited potential for replacement and low resilience to flood risk with a high potential for unacceptable consequences of flooding' e.g.

Sensitivity	Criteria
	• Surface water with a RBMP classification of 'High' • Land uses defined under the Planning Practice Guidance Flood Risk Vulnerability Classification as being "Essential Infrastructure" or "Highly Vulnerable" • Human receptors (site staff and visitors as well as nearby residents).

16.10 The magnitude of impact has been classified as low, medium or high, in accordance with the criteria set out in Table 16.2.

Table 16.2: Impact Magnitude Criteria

Magnitude of Impact	Criteria
Low	Small alteration/change in the quality or quantity of controlled waters and/or to the physical or biological characteristics of surface waters and associated flood risk, e.g. a minimal change in the frequency or depth of flooding such that the potential hazard is unaltered and existing mitigation is unaffected.
Medium	Medium alteration/change in the quality or quantity of controlled waters and/or to the physical or biological characteristics of surface waters and associated flood risk, e.g. a change in the frequency or depth of flooding such that the potential hazard is altered and existing mitigation may need adapting.
High	Large alteration/change in the quality or quantity of controlled waters and/or to the physical or biological characteristics of surface waters and associated flood risk, e.g. the introduction of flood risk to an area not previously at risk or changes of the characteristics of flooding such that hazards could not be mitigated.

16.11 Impacts have been assessed on the basis of the value/sensitivity of receptors against the magnitude of impact to determine the scale of effect (Table 16.3). Based on professional judgement, moderate and major effects are considered significant in EIA terms.

Table 16.3: Significance Criteria

Magnitude of Impact	Sensitivity of Receptor		
	Low	Medium	High
Low	None	Negligible	Minor
Medium	None – Negligible	Minor	Moderate
High	Minor	Moderate	Major

Consultation

16.12 A summary of consultation undertaken to date of relevance to flood risk and surface water drainage matters is provided in Table 16.4.

Table 16.4: Summary of Flood Risk and Surface Water Drainage Consultation to Date

Consultee	Date	Summary of Response	How comments have been addressed in this Chapter
Environment Agency (Scoping Opinion Response Letter)	4th May 2020	The EA highlighted that the continued structural integrity of the flood defences, (in the form of a concrete sea wall, embankment and seaward revetment along the southern boundary of the site and continuing offsite around the periphery of Canvey Island) is vital for the protection of the site and for the surrounding community.	Further discussion of the current status of the flood defence is provided in this chapter. As described in this chapter, the proposed works would not limit the EA's access to undertake inspections and maintenance of the flood defence and any new infrastructure which crosses the flood defence would be raised at such an elevation that future raising of the sea wall in line with the Thames Estuary 2100 (TE2100) Plan is not restricted.
Environment Agency (Scoping Opinion Response Letter)	4th May 2020	Whilst the site is defended, there remains the risk that flooding could occur as a result of defence failure and/or overtopping. It was indicated that this risk, and mitigation measures to address the risk must be considered as part of the Flood Risk Assessment.	The potential for the site to be impacted by a breach in the flood defences is considered to be very low. However, it is acknowledged that there remains a residual risk of such an occurrence. Mitigation against the potential impact of a flood defence breach is provided to the proposed tanks by the compound bunds as discussed in this chapter. Emergency procedures in response to potential flood risk are discussed in this chapter.
Environment Agency (Scoping Opinion Response Letter)	4th May 2020	The EA confirmed that flood defences will have to be raised in the next 50 years to maintain the existing standard of flood protection to Canvey as part of the TE2100 Plan. There is a requirement to ensure that the proposed development does not conflict with or compromise the ability to deliver future flood risk management infrastructure. In addition, the fuel conveyance infrastructure crossing the flood defence line from the jetties to storage facilities should be set at an appropriate height and lateral distance that recognises the future flood defence level/height and width.	The detail of proposed new structures in terms of location and designs has been determined by the Front End Engineering Design (FEED) study. It is anticipated that vehicle access would be provided on roads between the terminal fence and the adjacent compound bund walls which would allow for continued access to the site boundary fence adjacent to the flood defence embankment for visual inspections or improvement works. There is an existing access arrangement for the EA to undertake inspections of the embankment and such access arrangements will be retained. As set out in Chapter 3 and this chapter, all new pipelines from the Jetties into the facility will be constructed to enable the flood defence wall on the top of the embankment to be raised as

Consultee	Date	Summary of Response	How comments have been addressed in this Chapter
			necessary in the future. In addition, the DCO application will also contain provision, as necessary, for all existing pipelines to be similarly amended in the future if required
Environment Agency (Scoping Opinion Response Letter)	4th May 2020	The EA confirmed that the NPSfP states that "*Applicants should apply, as a minimum, the emissions scenario that the Independent Committee on Climate Change suggests the world is currently most closely following (the 10%, 50% and 90% estimate ranges)"* and '*in addition, where port infrastructure has safety-critical elements (e.g. storage of gas, petro-chemicals) the applicant should apply the high emissions scenario (high impact, low likelihood) to those elements critical to the safe operation of the port infrastructure'*.	As set out in this chapter, the peak in-channel flood levels for the River Thames used in the flood defence breach modelling, undertaken as part of the South Essex Level 1 SFRA[508], utilised the recommended climate change factors from the UKCP09 medium emissions 95%tile which to generate the extreme water levels with allowances for sea level rise for the 2116 scenarios. This exceeds the climate change 90% probability scenario required by the EA.
Environment Agency (Scoping Opinion Response Letter)	4th May 2020	When considering residual risk for the design and extreme flood events, the EA advised that an assessment should be made of the potential risk to the site for an 'un-warned' breach in the defences.	As explained, the embankment and sea wall are significant structures which are unlikely to be subject to a breach. Although a potential vessel impact event has previously been queried, the shallow foreshore would result in such an event being very unlikely. Therefore, the probability of a breach in the flood defence immediately adjacent to the site is considered to be very low. There remains a residual risk of flooding affecting the site were a breach to occur elsewhere on Canvey Island with flood waters migrating inland. Although the likelihood of such an event is low, the potential hazard could be significant and would be considered in construction methodologies as well as detailed design of the proposed development and ongoing emergency planning by Oikos.

[508] AECOM (2018) South Essex Strategic Flood Risk Assessment

Consultee	Date	Summary of Response	How comments have been addressed in this Chapter
Environment Agency (Scoping Opinion Meeting)	4th November 2020	A meeting was held with the EA on the 4th November 2020 in order to discuss matters including flood risk and ground conditions, including groundwater. This meeting also considered the specific relevant points raised in the EA's scoping opinion response in more detail. No specific concerns were raised by the EA. A query was raised by the EA as to location of new structures relevant to the flood defence embankment.	The information presented to the EA during this meeting is reflected within this chapter, specifically with regard to the site vulnerability, existing emergency procedures, and proposed flood resilience.

16.13 It is noted that the Scoping Opinion suggested that the applicant should also make effort to consult relevant Internal Drainage Boards (IDBs) on the approach to the FRA. There are no IDBs which have been identified as operating on Canvey Island, with the inland watercourses appearing to be managed by either the EA or Essex County Council as the Lead Local Flood Authority (LLFA).

16.14 A meeting was held with the LLFA on the 9th December 2020 in order to introduce the intended proposed development and the broad principles of emergency planning and surface water management at the site. No specific concerns were raised by the LLFA during the meeting.

Implications of Legislation, Policy and Guidance

16.15 The European Union (Withdrawal) Act 2018[509] provided that some EU legislation which applied directly or indirectly to the UK before 11.00 p.m. on 31 December 2020 has been retained in UK law as a new form of domestic law known as 'retained EU legislation' or 'retained EU law'. All references in this chapter to Directives, such as the Water Framework Directive, are to the Directives as they applied to the UK immediately before exit day – as they form part of retained EU law. Any statutory regulations which implemented Directives into UK domestic law, have, where necessary been amended by the government to make minor and technical changes required to correct any deficiencies in cross-referencing which arose as a result of the UK no longer being a member of the European Union. For example, The Water Environment (Water Framework Directive) (England and Wales) Regulations

[509] The European Union (Withdrawal) Act 2018

2017[510], has been amended by The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019[511].

International Legislation

Floods Directive (2007/60/EC)

16.16 The Floods Directive (Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks) (European Parliament, 2007)[512] came into force in November 2007 and requires all EU Member States to assess whether watercourses and coast lines are at risk of flooding and to map the associated flood extent, to identify the assets and people at risk within these areas. This is reflected in the online flood mapping data available via the EA. The EC Floods Directive was transposed into UK legislation by the 2009 Flood Risk Regulations, which are described below.

Water Framework Directive (2000/60/EC)

16.17 The Water Framework Directive (WFD) (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted by the European Commission (EC) in December 2000 (European Parliament, 2000)[513]. The WFD requires that all European Union (EU) Member States must protect and enhance the status of all aquatic ecosystems and prevent their deterioration, ensuring that new development does not adversely impact upon the status of aquatic ecosystems. The Water Framework Directive has been transposed into English law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended) which are described below.

16.18 Matters relating to the Water Framework Directive are included within the Water Environment chapter – Chapter 8 – of this PEIR.

National Legislation and Policy

National Policy Statement for Ports (NPSfP)

16.19 In respect of flood risk matters the (NPSfP) confirms that "*the aims of planning policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process*" [514]. This would seek to avoid inappropriate development in flood risk areas and for development to be directed away from areas at highest risk. Where new development is necessary in a high flood risk area, policy

[510] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

[511] The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019

[512] Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks

[513] Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy

[514] DfT (2012) National Policy Statement for Ports – paragraph 5.2.3.

aims to make the development safe without increasing flood risk elsewhere and where possible, reducing flood risk overall. Port development is stated as being water-compatible development and therefore acceptable in high flood risk areas[515].

16.20 Consistent with the requirements of the National Planning Policy Framework (NPPF)[516] – discussed in further detail in paragraphs that follow - the NPSfP confirms that all applications for port development of 1 hectare or greater in Flood Zone 1 in England and all proposals for projects located in Flood Zones 2 and 3 in England, should be accompanied by a flood risk assessment (FRA)[517].

16.21 The minimum requirements for FRAs are that they should:

- be proportionate to the risk and appropriate to the scale, nature and location of the project;
- consider the risk of flooding arising from the project, in addition to the risk of flooding to the project;
- take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;
- be undertaken by competent people, as early as possible in the process of preparing the proposal;
- consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure;
- consider the vulnerability of those using the site, including arrangements for safe access;
- consider and quantify the different types of flooding (whether from natural or human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;
- consider the effects of a range of flooding events, including extreme events on people, property, the natural and historic environment and river and coastal processes;
- include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;
- consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;

[515] DfT (2012) National Policy Statement for Ports – paragraph 5.2.3.

[516] Ministry of Housing, Communities & Local Government (2019) National Planning Policy Framework

[517] DfT (2012) National Policy Statement for Ports – paragraph 5.2.4.

- consider if there is a need to be safe and remain operational during a worst case flood event over the development's lifetime; and
- be supported by appropriate data and information, including historical information on previous events.

16.22 The NPSfP also suggests that further guidance can be found in the Practice Guide which accompanies Planning Policy Statement 25 (PPS25) or successor documents. PPS25 was superseded by the National Planning Policy Framework (NPPF) which was last updated in February 2019.

Overarching National Policy Statement for Energy

16.23 Section 5.5.1 (Coastal Change) of the National Policy Statement for Energy (NPSfE)[518] sets out that "*the Government's aim is to ensure that our coastal communities continue to prosper and adapt to coastal change. This means planning should:*

- *ensure that policies and decisions in coastal areas are based on an understanding of coastal change over time;*
- *prevent new development from being put at risk from coastal change by*
    - *avoiding inappropriate development in areas that are vulnerable to coastal change or any development that adds to the impacts of physical changes to the coast, and*
    - *directing development away from areas vulnerable to coastal change;*
- *ensure that the risk to development which is, exceptionally, necessary in coastal change areas because it requires a coastal location and provides substantial economic and social benefits to communities, is managed over its planned lifetime; and*
- *ensure that plans are in place to secure the long term sustainability of coastal areas."*

16.24 With specific regard to flood risk, the NPSfE repeats the minimum requirements for FRAs as set out in the NPSfP[519].

Flood Risk Regulations 2009

16.25 The purpose of the Flood Risk Regulations 2009[520] (as amended) is to transpose the EC Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) into domestic law and to implement its provisions. In particular, it places duties on the EA and local authorities to prepare flood risk assessments, flood risk maps and flood risk management plans.

[518] Department of Energy and Climate Change (2011) Overarching National Policy Statement for Energy (EN-1).

[519] Department of Energy and Climate Change (2011) Overarching National Policy Statement for Energy (EN-1) - paragraph 5.7.5.

[520] Flood Risk Regulations 2009

Flood and Water Management Act 2010

16.26 The Flood and Water Management Act 2010[521] (as amended) provides for better, more comprehensive management of flood risk for people, homes and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges, and protects water supplies to the consumer as well as aiming to reduce the flood risk associated with extreme weather.

16.27 The act also provides lead local flood authorities and the EA with a power to request information required in connection with their flood risk management functions.

National Planning Policy Framework (NPPF) (2019) and Supporting Guidance

16.28 The NPPF was most recently updated in February 2019, with flood risk remaining primarily regulated through planning policy. The NPPF is supported by Planning Practice Guidance[522] which confirms that an FRA should be submitted with planning applications for all development sites within Flood Zones 2 and 3; for all development sites in Flood Zone 1 that involve: (i) over one hectare (ha) in area; (ii) land which has been identified by the EA as having critical drainage problems; (iii) land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use[523].

16.29 The Planning Practice Guidance sets out that flood risk should be defined according to Flood Zone 3b (The Functional Floodplain), Flood Zone 3a (High Probability), Flood Zone 2 (Medium Probability) and Flood Zone 1 (Low Probability). Flood Zone 3b comprises land where water has to flow or be stored in times of flood. Flood Zone 3b is not separately distinguished from Flood Zone 3a on the EA's Flood Map[524]. Flood Zone 3a represents land that the Environment Agency (EA) consider could be affected by flooding:

- from the sea by an event with a 0.5 % (1 in 200) or greater chance of occurring each year; or
- from a river by an event with a 1 % (1 in 100) or greater chance of occurring each year.

16.30 Flood Zone 2 represents land that the EA consider could be affected by flooding: (i) from the sea by an event which has a between a 0.5% (1 in 200) to 0.1% (1 in 1,000) chance of occurring each year; or from a river by an event which has a between 1% (1 in 100) to a 0.1 % (1 in 1,000) chance of occurring each year.

---

[521] The Flood and Water Management Act 2010

[522] Ministry of Housing, Communities & Local Government (2019) *Planning Practice Guidance*. Available at: https://www.gov.uk/government/collections/planning-practice-guidance

[523] Ministry of Housing, Communities & Local Government (2019) *National Planning Policy Framework* – paragraph 163 and footnote 50.

[524] http://apps.environment-agency.gov.uk/wiyby/cy/151263.aspx

16.31 Flood Zone 1 represents land assessed as having less than a 1 in 1,000 (0.1 %) annual probability of flooding from rivers or the sea.

16.32 In terms of flood risk, the Flood Risk and Coastal Change Planning Practice Guidance[525] classifies land uses according to vulnerability as follows:

- Essential infrastructure;
- Highly vulnerable;
- More vulnerable;
- Less vulnerable; and
- Water-compatible development.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended)

16.33 The Water Framework Directive has been transposed into English law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended by The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019). The WFD introduced a new system for monitoring and classifying the quality of surface and groundwaters which involves establishing the existing ecological and chemical status of each water body, setting environmental objectives and devising programmes of measures to meet those objectives.

Water Resources Act 1991, Water Act 2003 and The Environmental Permitting (England and Wales) Regulations 2016

16.34 The Water Resources Act 1991[526] regulates water resources, water quality and pollution, and flood defence, aiming to prevent and minimise pollution of water. The Act set out the duties of the EA with regard to flood defence and water. The EA were given discretionary powers to improve and maintain river conditions and were granted the powers to issue flood warnings and regulate what can be discharged into rivers, estuaries, coastal waters, lakes and groundwaters.

16.35 The Water Act 2003[527] amends the Water Resources Act 1991 and the Water Industry Act 1991 to make provision in connection with land drainage and flood defence and amends the Reservoirs Act 1975 to make provision about contaminated land in so far as it relates to the pollution of controlled waters. The Water Act 2003 sets out the framework for abstraction licensing, regulates impoundments, increases competition in water supply and includes measures for drought management and flood defence works in England and Wales.

[525] https://www.gov.uk/guidance/flood-risk-and-coastal-change, Paragraph 066 Reference ID: 7-066-20140306

[526] The Water Resources Act 1991

[527] The Water Act 2003

16.36 The Environmental Permitting (England and Wales) Regulations 2016[528] (as amended) provide for the regulation of specified installations and controls over emissions to the environment. The Regulations replace those parts of the Water Resources Act 1991 that relate to the regulation of discharges to controlled waters (including groundwater).

Preliminary Description of the Existing Environment

Site Hydrological Setting

16.37 The nearest surface water features to the site of the OMSSD project are the River Thames immediately south, Sluice Dyke and Holehaven Creek to the west, and a network of drains to the east which discharge into Thorney Creek and then the Thames – see Figure 16.1.

16.38 This reach of the River Thames (Thames Lower) is defined by the EA under its Catchment Data Explorer[529] as a transitional water which is heavily modified. The second cycle of river basin management under the WFD runs from the publication of RBMPs in 2015 until 2021. The River Thames (Thames Lower) is classified as being of Moderate ecological potential and a Fail in terms of chemical criteria due to factors such as physical modification and a range of point source and diffuse sources of pollutants. The Thames itself is therefore considered to be of Low sensitivity in water quality terms although changes in flood risks associated with the Thames could range from Low to High depending on the vulnerability of the land use affected by flooding or the presence of human receptors in an area at risk of flooding.

16.39 There are other ordinary or minor watercourses within 100m of the site of the proposed OMSSD project which are not defined under the Catchment Data Explorer.

Flood Zone Status

16.40 As shown in Figure 16.2, the entire Oikos Facility is shown to be located within Flood Zone 3a (High probability of flooding) which, as the River Thames is tidally influenced at this location represents land with greater than a 1 in 200 (0.5% annual probability of tidal flooding in the absence of flood defences). The extent of Flood Zone 3 specifically ignores the presence of flood defence assets and in this case, therefore, ignores the significant tidal flood defence asset which is in place along the southern boundary of the Oikos Facility. With the benefit of this defence, the flood risk at the facility is considered to be significantly lower than typically associated with Flood Zone 3.

16.41 Flood Zone 3 is sub-divided into Zone 3b (the functional floodplain) where the land is such that water has to flow or be stored in times of flood. However, areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid

[528] The Environmental Permitting (England and Wales) Regulations 2016

[529] https://environment.data.gov.uk/catchment-planning/WaterBody/GB530603911401

buildings, will not normally be identified as functional floodplain. Therefore, the site should not be considered as being within the functional floodplain and would remain in Flood Zone 3a. The Castle Point SFRA confirms that the site is not within the functional floodplain.

Flood Defence

16.42 The South Essex Level 1 SFRA[530], produced in 2010, confirms that much of Canvey Island is at, or below, mean high tide level and in response to this, formal raised sea defences protect the entire island. In addition to these defences, the Benfleet Creek, East Haven Creek and Fobbing Horse flood barriers are operated by the EA to protect the Borough in times of flooding.

16.43 The SFRA also confirms that the existing flood defences provide between a 1 in 200 and 1 in 1,000 annual probability Standard of Protection (SoP) to Castle Point; i.e. they protect against tidal flood events with an annual probability of between 0.5% and 0.1%.

16.44 The SFRA states that EA data shows that Castle Point Borough is protected from tidal flooding by the following defences:

- Benfleet Creek Barrier – flood barrier to control tidal water levels on the Benfleet Creek;
- East Haven Barrier – flood barrier which controls tidal water levels on the East Haven creek;
- Secondary tidal defences (raised earth embankments) along East Haven Creek;
- Formal sheet pile walls to tie into flood barriers;
- Formal concrete flood defences along the remaining perimeter of Canvey Island; and
- Raised earth embankments along the southern boundary of Hadleigh Marsh.

16.45 The sea wall and embankment on the southern boundary of the Oikos Facility is regularly inspected by the EA and, according to the geospatial data library maintained by DEFRA on behalf of the EA[531], is currently in 'fair' condition as presented in Figure 16.3. The embankment and associated flood gates are shown to have last been inspected on 17th January 2020 and were due for reinspection on the 17th January 2021 (it is not clear, at the time of writing, if this inspection has been carried out.)

16.46 Design drawings of the sea wall and embankment have been provided by the EA. These drawings were produced in June 1984 by the Anglian Water Authority. The drawings indicate that the flood wall at the top of the embankment has a crest height of 6.95 mAOD with significant engineered measures to maintain the structural integrity of the defence. The DEFRA geospatial data library states that the effective crest height of the defence is

[530] AECOM (2018) South Essex Strategic Flood Risk Assessment

[531] https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/SpatialFloodDefencesIncStandardisedAttributes&Mode=spatial

currently at 6.82 mAOD. The flood gates shown to be present along the embankment adjacent to the site are shown to have a crest height of 6.93 or 6.95 mAOD.

16.47 The EA data also shows that the majority of Canvey Island is protected by a concrete wall that spans the southern coastline of the island, with a design Standard of Protection (SoP) of 1 in 1000 year (Figure 16.4). There are also flood defence assets shown along inland watercourses north of the site. These constitute high ground along the banks of the watercourses and are also maintained by the EA although no standard of protection or defence crest level is provided.

16.48 Therefore, as a result of existing flood defences, the tidal flood risk to the Oikos Facility and to surrounding land is currently considered to be low.

Sea Level Rise

16.49 Due to the potential impacts from climate change, it is anticipated that the SoP afforded by the flood defences could reduce over time due to anticipated rise in sea levels if no improvement works were undertaken. However, in accordance with the EA's TE2100 Plan[532], infrastructure currently in place would be improved and raised in the future, and any new infrastructure which crosses the sea wall will need to be set at an elevation such that any future raising of the crest level of the sea defences is not restricted.

16.50 The SFRA states that the "*TE2100 Plan states that the policy for Canvey Island in Castle Point is 'P4' (to take further action to keep up with climate and land use change so that flood risk does not increase. The drainage systems on Canvey Island will require upgrading as the sea level rises and rainfall increases from climate change. This will consist of improvements to channels and outfalls as the need arises. The replacement of the Benfleet, East Haven and Fobbing Horse moveable gate barriers for fixed defences is a possibility for the future although it will be a costly option*"[533].

16.51 The current government guidance[534] suggests that, for Nationally Significant Infrastructure Projects (NSIPs) such as new harbours, roads, power stations and power lines, flood risks may need to be assessed from a credible maximum climate change scenario. This also applies for new settlements or significant urban extensions.

16.52 Therefore, there may be considered a requirement to assess the flood risk to the proposed development from a high impact climate change scenario. The government guidance states this to be the High++ (H++) scenario and that this should be treated as a 'sensitivity test' to help assess how sensitive the proposal is to changes in the climate for different future scenarios. The intention of this guidance is to ensure that the development can be adapted to large-scale climate change over its lifetime.

---

[532] Environment Agency (2021) Thames Estuary TE2100 Plan (Updated February 2021). Available at: https://www.gov.uk/government/publications/thames-estuary-2100-te2100/thames-estuary-2100-te2100

[533] AECOM (2018) South Essex Strategic Flood Risk Assessment, Section 5.2.1

[534] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

16.53 A report on the H++ climate change scenario was published by the Met Office, University of Reading and CEH for the Adaptation Sub-Committee in 2015[535]. This confirms that the H++ scenarios were used to inform the TE2100 Plan. The H++ sea level rise and storm surge scenarios were used to inform the TE2100 Plan to support engineers to implement plans that will help protect London from any plausible increase in coastal flood risk up to 2100. The current flood defence provisions and future proposed increases to the flood defence are, therefore, designed such that the site would be protected against a high impact (H++) climate change scenario.

Flood Defence Breach Modelling

16.54 The EA has stated that the current modelling of potential flood defence breaches in the vicinity of the site is the 'Thames Estuary Breach Assessment' which was completed in 2018. However, the EA is unable to provide any data derived from this modelling as the breach element of the model is under review due to discrepancies that have been discovered, which means that the results are not considered accurate. The issues with the data have not been resolved and to release the information currently could mean that incorrect flood risk information could be used to inform any potential development application. It is understood that there are no current proposals to update the modelling and it is advised that the SFRA and associated modelling is used to assess the potential risks associated with a flood defence breach.

16.55 The SFRA states that "*Canvey Island is particularly vulnerable in the unlikely event of a flood defence failure as it is possible that Canvey Island could be cut off from the mainland. The low-lying marshland and drainage channels on Canvey Island provide pathways for floodwater. Drainage channels within Canvey Island include channels west of the A130, 'The Lake', a creek adjacent to the Dutch Village and Thorney Creek Fleet. Given the wide flat topography of the island, large areas could be inundated quickly following a breach event as flooding pathways are not very well defined. Although the chances of the defences failing or being overtopped are very small, the consequence of such a failure in Castle Point Borough is very high.*" [536]

16.56 Hydraulic modelling of the potential consequence of a breach in the tidal flood defence at locations along the Castle Point Borough frontage was undertaken as part of the SFRA. The sections where a potential breach was assessed included sections of walls, flood barriers, embankments or raised ground as listed below in Table 16.5. The modelled potential breach location CAS03 is on the southern boundary of the site close to the original outfall from the site's surface water drainage system at the foot of Jetty 3, whilst CAS02 is a short distance off-site to the west on Holehaven Creek and CAS04 a short distance off-site to the east at Thorney Bay. These key modelled flood defence breach locations are presented in Figure 16.5. Other modelled potentials breach location further from the site have also been

[535] Adaptation Sub-Committee, Developing H++ climate change scenarios for heat waves, droughts, floods, windstorms and cold snaps, October 2015

[536] AECOM (2018) South Essex Strategic Flood Risk Assessment, Section 5.2.2

considered as there may remain a potential for flood waters to migrate towards the site across Canvey Island. It is noted that the modelling does not consider the likelihood of a breach which remains low. The selection of the potential breach location is not suggestive of an increased probability of a breach at that location.

Table 16.5: Flood Defence Breach locations as modelled within SFRA

Breach Name	Breach Location	Defence Type	Grid Reference
BAS01	Flood barrier, Fobbing Horse, Vange Creek	Barrier	574045, 184306
CAS01	Upper Horse	Wall	575200, 183400
CAS02	Canvey Village, Lower Horse	Wall	577100, 182600
CAS03	STW	Wall	578100, 182000
CAS04	Canvey Island Golf Course	Wall	579438, 182463
CAS05	Leigh Beck	Wall	581600, 182700
CAS06	Sunken Marsh	Wall	580900, 184300
CAS07	Castle Point Golf Course	Wall	579009, 185005
CAS08	Benfleet Creek Flood Barrier	Flood Barrier	578068, 185605
CAS09	Easthaven Barrier	Embankment	574757, 184282
SOU01	Hadleigh Marsh	Earth (estuary)	583160, 185661

16.57 The following flood events were considered within the modelling:

- 1 in 200 year event (0.5% AEP) present day (2016), with flood barriers operational;
- 1 in 1000 year event (0.1% AEP) present day (2016), with flood barriers operational;
- 1 in 200 year event (0.5% AEP) with climate change (2116), with flood barriers operational and non-operational; and
- 1 in 1000 year event (0.1% AEP) with climate change (2116), with flood barriers operational and non-operational.

16.58 The hydraulic modelling was undertaken using 2D hydraulic modelling software MIKE21-HDFM (ver. 2009). The model simulates 3 tidal cycles with the peak level occurring on the second peak and two slightly smaller peaks either side. Breaches in the defence walls are modelled to occur immediately before the peak tidal level to assess the potential impact of rapid inundation of floodwater.

16.59 The peak in-channel flood levels for the River Thames used in the modelling were derived from the Thames Tidal Defences, Joint Probability Modelling (2008). It is stated in the SFRA that, for the 0.5% (1 in 200 year) and 0.1% (1 in 1000 year) AEP 2116 scenarios, the recommended climate change factors (UKCP09 medium emissions 95%tile) were applied to generate the extreme water levels with allowances for sea level rise for the 2116 scenarios.

16.60 The maximum flood depth is calculated by subtracting the LIDAR topographic data from the peak water level achieved at each element in the model throughout the simulation. Extracts

of the SFRA mapping, showing the peak flood depths for the scenarios listed above, are presented in Figures 16.6 to 16.13.

16.61 The mapping suggests that the presence or absence of the barriers appears to make little difference on flood depths within the site. The peak flood depths (i.e. those associated with a climate change adjusted 1 in 1,000 annual probability tidal event in 2116) appear to be less than 2m with the majority of flood waters less than 1m in depth. It is noted that the proposed new tank compound bunds would be between approximately 2.8 and 4m in height above existing ground levels such that flood depths at the site as predicted by the SFRA modelling would not impact on the tanks themselves.

Historic Flooding

16.62 EA online geo-spatial data[537] shows that the Oikos Facility was subject to flooding in 1953, as presented in Figure 16.14 due to overtopping of the tidal defences existing at that time. However, the current flood defences in this area were all constructed after 1953 which significantly increased the standard of protection afforded to the Oikos Facility such that the extent of flooding experienced in 1953 is no longer representative of current flood risk.

Site Flood Warning System and Current Management Plan

16.63 As part of its flood plan, Oikos is signed up to receive advance adverse weather and possible tidal surge warnings (Flood Warning Direct) from the Port of London Authority and EA, which allows Oikos time to implement the flood plan if necessary. This could involve shutting down the facility, isolating equipment and evacuating personnel. Procedures are also in place to ensure that post any flooding, the correct checks are made to remove all floodwater and begin operations after the integrity of plant and equipment has been verified.

Surface Water Drainage

16.64 Surface water runoff from the site is currently collected via a network of above and below ground drainage assets which serve the existing tank compounds as well as other areas of hardstanding. Rainwater which falls into the existing tank compounds is retained within the compound and is only manually drained from the compound sump into the wider site's drainage network, when required by starting a pump having carried out a visual check of the retained water for the presence of any product from the tanks. As the tank compounds are contained within bunds with walls at least 2.5m in height and an impermeable base, there is significant capacity within the site to accommodate extreme volumes of rainfall without any damage to equipment or uncontrolled discharge of surface water.

16.65 Improvements to the surface water drainage system across the Oikos Facility were completed during the last four years as part of a previous development project at the facility. Following discharge from the compounds, all surface water runoff is routed through an

[537] https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/RecordedFloodOutlines&Mode=spatial

interceptor and oil recovery system in the south-east of the site into a surface water containment tank. The surface water containment tank has a level control which automatically pumps surface water to the outfall which is located at Jetty 3 to the tidal Thames Estuary. Sampling of the outfall is undertaken once a week.

Environmental Change without the OMSSD Project

16.66 It is noted that the new infrastructure will have a design life of 30 years, which means that up to that point, it is expected that any subsequent works to the new infrastructure is likely to comprise of minor repairs only. At the end of this period it is likely that consideration will need to be given to whether more substantial works are needed to extend the design life of the infrastructure developed as part of the OMSSD project. Oikos envisage that the infrastructure developed as part of the OMSSD project will continue to be used – possibly with appropriate adaptations and amendments - for the handling and storage of bulk liquid products beyond this 30 year period.

16.67 Although the expected life expectancy of the tanks is 30 years before significance maintenance is likely to be required, it is acknowledged that the terminal operation will likely last for a much longer period. As port operational land the site is unique in having access to deep water and connections to two national fuel distribution pipelines on site. Therefore, any assessment of the impacts of climate change on flood risks should consider a lifespan beyond 2080. Flood risk is projected to increase in the future as a result of climate change and sea level rise. The dominant increase in flood risk for the OMSSD project is considered to be tidal flood risk resulting from increased sea levels.

16.68 The detailed design of the proposed surface water drainage network will, therefore, also consider the potential effects of climate change in line with government guidance[538] which currently requires that a 40% increase in rainfall depths be considered.

16.69 Apart from the effects of climate change upon flood risk, it is considered that the conditions identified now will still be representative of the water environment at the time of construction and throughout the operation of the OMSSD project.

Preliminary Consideration of Likely Impacts and Effects

16.70 Matters relating to human health and climate matters are incorporated as necessary into the preliminary assessment that follows.

[538] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Tidal Flood Risk

16.71 Due to the presence of the existing flood defence embankment, it is not anticipated that the proposed works would have any impact on the current extent of the tidal floodplain; the site and all proposed works are removed from the natural floodplain. Although sea levels are anticipated to rise due to expected climate change, the current height and SoP afforded by the flood embankment and crest wall provides resilience against sea level rises in the short term future. Although it is anticipated that the SoP afforded by the flood defences could reduce over time due to anticipated rise in sea levels, in accordance with the EA's TE2100 Plan, infrastructure currently in place would be improved and raised in the future. Any new infrastructure which crosses the sea wall could, if not designed appropriately, present a future constraint to the raising of the flood defence crest height.

16.72 It was confirmed through consultation with the EA that it is not necessary to undertake detailed hydraulic modelling of a potential breach scenario as a catastrophic breach of the flood defences would result in flooding across the site (as confirmed by modelling undertaken as part of the SFRA). However, the embankment and sea wall are significant structures which are unlikely to be subject to a breach. Although a potential vessel impact event and the associated potential for an 'un-warned' breach in the defences, has previously been queried by the EA, the shallow foreshore in front of the sea wall means that such an event is very unlikely because vessels would run aground before getting close to the flood defence wall. Other navigation controls are also in place to prevent such an event occurring. Therefore, the probability of a breach in the flood defence immediately adjacent to the site is considered to be very low.

16.73 The likelihood of any change to the flood risk status of the site or the surrounding land uses is considered to be of Low magnitude. Therefore, while the sensitivity of the site and its surrounds may be High in terms of flood risk, the overall effect is likely to be considered to be of minor significance.

16.74 There does remain a residual risk of flooding affecting the site were a breach to occur elsewhere on Canvey Island with flood waters migrating inland. Although the likelihood of such an event is low, the potential hazard could be significant and would need to be considered in construction methodologies as well as detailed design of the proposed development and ongoing emergency planning by Oikos.

Surface Water Management

16.75 The proposed development would change the existing surface water runoff regime within the site due to proposed changes to areas of impermeable surfacing, new compound bunds and associated infrastructure. If the surface water drainage network for the site was not appropriately upgraded to serve the new proposals, this could result in a change to surface water flood risks within the site. However, any such flood risk would be likely to be contained within the site as the presence of the tidal flood defence embankment separates the site from any downstream catchment.

16.76 Furthermore, as the River Thames is tidal at this location, any changes to the surface water pumping regime would not result in any changes to the water levels within the Thames and would not, therefore, result in any increase in downstream flood risk.

16.77 Either during construction or during the operation phase of the proposed development, there is a potential that the regular discharge of surface water runoff to the River Thames could present a pathway for the release of pollutants, including silt in surface waters and accidental spillages of contaminating substances such as fuel and cement. Impacts are likely to be temporary and localised. The existing discharge arrangement, with water being routed via an interceptor and oil recovery system in the south-east of the site into a surface water containment tank and sampling of the outfall once a week, would be maintained throughout construction and post-development in order to reduce the potential for such releases of pollutants.

16.78 Due to the proposed management of surface water runoff volumes within the completed development, the magnitude of any change to surface water flood risk is considered to be Low. The discharge of surface water to the Tidal Thames would not result in any change to the flood risk status. Therefore, the potential effect is considered to be of minor significance.

16.79 Similarly, due to the surface water quality mitigation (interceptor, oil recovery system and sampling of the outfall) the magnitude of impact as a result of routine site drainage on water quality on the Thames is considered to be Low, resulting in an overall effect of no greater than minor significance. The Thames is also currently designated, under the EA's second cycle of river basin management planning, as being of Moderate Ecological potential and a Fail in terms of chemical criteria such that no potential significant effect is expected.

16.80 During construction, there is potential, if unmitigated, for greater concentrations of pollutants to be generated on-site. However, surface water management procedures would be in place throughout construction such that potential significant effect would be expected.

Potential Mitigation Measures

Flood Defence Improvements

16.81 The detail of proposed new structures in terms of location and designs are described within Chapter 3 of this PEIR. It is anticipated that vehicle access will be required around the compounds including roads between the terminal fence and the adjacent compound bund walls. This would allow for continued access to the site boundary fence adjacent to the flood defence embankment for visual inspections. There is an existing access arrangement for the EA to undertake inspections of the embankment and such access arrangements would be retained.

16.82 It is acknowledged that aspirations in the EA's TE2100 Plan include the need to raise the flood defences in the future in response to climate change. It is considered likely that the raising of the flood defence crest would be achieved in the future through increases to the height of the crest wall on top of the embankment. It is not considered feasible for the flood

defence embankment itself to be significantly increased as this would in turn require widening of the embankment towards existing site assets as well as onto the foreshore.

16.83 As set out in Chapter 3, all new pipelines from Jetty 1 into the facility would be constructed to enable the flood defence wall on the top of the embankment to be raised as necessary in the future. It is also envisaged that the OMSSD DCO application will also, as necessary, contain provision for all existing pipelines to be similarly amended in the future if required. The Jetty 2 pipeline gantry over the embankment is considered to already allow for the flood defence wall to be raised in future.

Compound Bund Design

16.84 The proposed storage tanks would be located within bunded compounds that would be designed to retain any catastrophic releases from the tanks as well as contaminated rainwater but would also provide resistance to ingress of flood waters to the tanks. In common with the existing compounds on site, the new tank compounds would have impermeable floors surrounded by impermeable concrete bunds.

16.85 An impervious base across the whole of each compound area will be installed. This involves the removal of existing material within the compound area and the placement of an impervious bentonite / clay base mat layer.

16.86 It is anticipated that the new tank compound bund walls will be between 2.8 and 4m in height above ground level. The compounds and impermeable bund walls are sized to provide sufficient capacity for 110% of the product stored in the largest tank within the compound plus rainwater, plus potential firewater. The bunds would be designed to be structurally secure in the event of a catastrophic release of product from a tank. Therefore, the bunds would also be able to withstand flood waters on the exterior of the bund.

16.87 A new compound wide drainage system will be installed for each compound. This drainage system will be created in the infill material area within the compound and drain to newly created sump chambers, from which the water can then be manually pumped into the site wide drainage system when appropriate to do so. Each compound drainage system would remain closed in terms of downstream discharge such that waters would only be manually released when necessary. This means that the flood protection afforded by the bunds would remain in place at all times except when surface water is being released. This would not occur when a flood warning has been issued.

Flood Resilient/Resistant Design

16.88 In addition to the pipeline manifold and distribution plant infrastructure, other operational infrastructure would also be provided (including switchrooms or Motor Control Centres (MCC)). This operational infrastructure would be located on concrete hardstanding, bunded as necessary.

16.89 Due to the low risk of flooding at the site after consideration of existing flood defence infrastructure, it is not considered necessary to utilise flood resilient/resistant design methods

for the construction of this infrastructure. Were there to be a flood defence breach (considered a highly unlikely risk) it is unlikely that any flood resilience/resistance would be successful due to the potential extent and depth of flooding. Any infrastructure outside of the tank compound bunds would be at risk of flooding during such an event. However, any operational infrastructure could be shut down safely and remotely in the event of a flood such that no releases of product would occur.

Flood Warning System and Management Plan

16.90 Oikos already have an Emergency Flood Plan in place as part of the COMAH (Control of Major Accidental Hazards) requirements. The operational procedures at the site allow for a rapid shut down of operations within the site. If required in an emergency situation, a manually activated shutdown button can be used to shut down and isolate the whole site operation such that product remains retained within the storage tanks and pipeline systems. Staff can then be evacuated from the site. Any new infrastructure would also be similarly controlled such that rapid safe shut down of operations could be achieved.

16.91 In the event of a flood, the evacuation of all personnel from the site following safe shut down would be prioritised. There are no areas within the site where dry access or egress would be available were there to be a catastrophic breach of the flood defence. The current arrangement is for staff to evacuate on foot to the top of the flood defence embankment along the southern boundary of the site, and for evacuation to continue along this raised feature (significantly higher than anticipated flood levels), away from flood waters. An access route to the sea wall embankment is currently provided and would be maintained post-development.

16.92 Details of the associated works which will form part of the OMSSD project will be determined as part of the ongoing design process and will include a new workshop and stores buildings, along with an extension to the existing administration/operations office building. However, it is likely that these buildings would only be single storey and should not be used to provide emergency safe refuge during a flood event. The utilisation of safe refuge on-site during a flood would not be considered as a primary response to a flood event, even if upper storeys were available, with the priority being the evacuation of all personnel from the site following safe shut down.

Surface Water Drainage Management

16.93 It is anticipated that a Construction Environmental Management Plan (CEMP) will be prepared. With regard to surface water management, the CEMP will include a commitment to environmental protection along with detailed control measures and activities to be undertaken to minimise likely environmental impacts, as well as associated roles and responsibilities. Specific measures within the CEMP to avoid and minimise the potential for new sources of contamination to arise and to cause significant effects in respect of surface water resources will include the following:

- Regularly maintaining construction vehicles and plant to reduce the risk of hydrocarbon contamination;

- Storing, handling and managing construction materials with due regard to the potential for mobilisation into surface drainage;
- Locating above-ground storage tanks and temporary welfare facilities on designated areas of hardstanding or protected areas away from potential surface drainage routes;
- Storing liquids such as degreasers, solvents, lubricants and paints in segregated or bunded enclosures; and
- Ensuring that any tanks storing significant volumes of oil on-site have secondary bunding.

16.94 As set out above, a new compound wide drainage system would be installed for each compound. This drainage system will be created in the infill material area within the compound and drain to newly created sump chambers, from which the water can then be manually pumped into the site wide drainage system when appropriate to do so. Each compound drainage system would remain closed in terms of downstream discharge such that waters would only be manually released when necessary.

16.95 In addition to the installation of a new drainage system within the new compounds, outside of the compounds new below ground drainage systems will be installed to connect to the existing site drainage system which already includes interceptor and attenuation infrastructure with associated outfall pumps and discharge pipework.

16.96 All surface water runoff would remain ultimately discharging via the same existing outfall into the tidal River Thames. Due to the tidal nature of the River Thames at this location, any changes to the surface water pumping regime would not result in any changes to the water levels within the Thames and would not, therefore, result in any increase in downstream flood risk.

16.97 The detailed design of the proposed surface water drainage network would also consider the potential effects of climate change in line with government guidance[539] and a 40% increase in rainfall depths would be considered. The network will be designed to accommodate a 1 in 100 (1%) annual probability event, whilst also considering a 40% increase in rainfall depths, without there being any unmanaged flooding of vulnerable areas of the site.

Limitations

16.98 The preliminary assessment of the potential effects of the proposed development in terms of flood risk and surface water is reliant on the accuracy of third party data; specifically relating to the condition grade and standard of protection afforded to the site by the EA's flood defence assets. It is assumed for the purposed of the assessment that ongoing maintenance and subsequent improvements to the flood defence would be undertaken in due course in accordance with the TE2100 Plan. The proposed development would not limit

[539] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

the capability of the EA to inspect the flood defence asset and make future improvement (through the provision of suitable access and the design of any infrastructure which crosses the flood defence).

Preliminary Conclusions on Residual Effects

16.99 As a result of the design interventions and likely mitigation described above, it is anticipated that the potential residual impacts of the development on the environment in terms of flood risk, and associated with discharge of surface water (both during and post-construction/demolition works) would be minor or negligible. The proposed development would not be anticipated to lead to any increase in the vulnerability of the Oikos site to flood risk and would not introduce any new pathways for flood risk to be increased to downstream receptors.